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Electronic data interchange (EDI): Application of EDI and its impact on information quality

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ABSTRACT

Electronic Data Interchange (EDI) is the electronic transmission or movement of business data, information and documents from one business' computer system to another system in a standardized format. This movement is in a structured data format that permits data to be transferred without rekeying from a computer-supported business application in one location to another such system elsewhere. This technologically advanced mode of business transactions is fast becoming the operating "norm" for many areas of the business world. EDI is not electronic mail or FAX. They do not generate computer-processable information. EDI is not an application; it performs no business transactions and it generates no information. EDI integrated into a company's business system creates direct information-processing links between business. The paper addresses the applications of EDI and looks at possible impact on information quality.

INTRODUCTION

EDI can trace its roots back to the post-World War II era. The automobile, transportation and retail industries were among the nations' first users of EDI. The government has been moving forward with EDI in the recent years. In 1994, President Clinton signed the Federal Acquisition Streamlining Act (Public Law 103-355) which was designed to simplify and Streamline the Federal procurement process. With this, the Defense Information System Agency (DISA) has been designated as the responsible agency for maintaining Department of Defense (DOD) information technology standards and conventions. With DISA, the Center for Standards, part of the joint Interoperability and Engineering Organization, is the designated configuration manager for DOD electronic Commerce/Electronic Data Interchange (EC/EDI) standards.

EDI, along with the company's financial and business data systems, creates a direct link between customers and suppliers. There are significant opportunities to conduct business in an electronic environment in both domestic and international markets.

What are the Major Benefits of EDI?

- Increased business opportunities through wider diffusion of procurement information;
- Improved quality through improved record-keeping, fewer errors in data, reduced processing delays, less reliance on human interpretation of data, and minimized unproductive time;
- Greater savings from reduction of inventories, mailroom sorting/distribution time, elimination of lost documents, and reduction of postage and other mailing cost;
- Reduced order time; and,
- Better and more up-to-date information for management decision-making.

FORMS OF EDI

There are several forms of electronic data interchange in use in the business industry. Each system has different functions for specialized purposes. Probably the best known form of EDI is a purchasing system format called Trade Data Interchange (TDI). This system facilitates the electronic movement of documents such as purchase orders, invoices, and acknowledgments.

Another familiar type is Electronic Funds Transfer (EFT) which is the automatic transfer of funds. The Social Security Administration has been making EFT payments of Social Security checks since 1986, saving \$60 billion in postage costs. For businesses, funds can be transferred through the computer system. This electronic process eliminates the need for personnel to manually process these transactions, saving time, processing, and manpower costs.

Interactive Query response is another form of EDI used by the travel industry. A travel agent can access various flight listings for particular destinations, view the listings by the desired travel criteria, make the reservation, and print the ticket.

A fourth type of EDI is Graphics Transmission in which automatic transmission of graphics materials can be used to transmit engineering plan and drawing prepared with computer aided design (CAD) systems and expert knowledge system.

APPLICATIONS OF EDI

The EDI technology has totally taken over the retail and wholesale business industry. For the foreseeable future, speed will be the name of the game in retail. Customers are demanding it and leading mass merchandisers are offering it. The more sophisticated suppliers are viewing it as providing an excellent service while simultaneously reducing the cost of doing business. Major mass merchandisers such as Wal-Mart, Target, and K-Mart are driving the trend that logistical speed is a competitive necessity that, done right, results in a competitive advantage. This is

putting a tremendous amount of pressure on retailers because there is little or no tolerance for inaccurate forecasts, slow moving items, and excess inventory. Without a move to the EDI technology the marketplace will be increasingly unforgiving.

It has been noted that there are customers willing or wanting to buy the goods that will be produced and offered for sale. With this in mind the retailers and manufacturers who are to survive into the next century will have to be a part of this technology. EDI is considered to be the tool for the faster services; however, information systems will increasingly sustain or supplement closer and faster retailer/vendor relationships. There are two essential technological ingredients in building a more responsible retail environment. First, telecommunications between retailers, wholesalers, and suppliers will ensure that timely information is traded among all parties in the pipeline. Second, sophisticated analytics are essential. Leading edge Information Systems (IS) will be able to instantly pinpoint hot items and manage purchasing and restocking activity. This will do away with after-the-fact category management in which sales are analyzed weeks later to determine stocking levels for the next month. Retailers are learning that such a process carries the cost of lost opportunity. Point-of-purchase replenishment systems will become increasingly valuable to the retailers.

In a typical business-to-business transaction (without EDI) a customer sends an order to a supplier using a purchase order which is mailed or faxed. The order may be telephoned in, followed up with the paper work. The supplier then prepares its own internal paper work to process the order and arrange shipment and sends the customer the invoice. The customer receives the invoice and writes a check to the supplier and mails it. The supplier receives the check and takes it to the bank for deposit. With even a simple EDI system, most of the operations in this set of transactions could be done in half the time and without any paper.

IMPACT OF EDI ON END USERS

With an EDI system, the customer types the purchase order into the computer system. The computer sends the transaction electronically to the supplier, whose own computer generates the orders necessary to make the shipment. The invoice returns to the customer electronically through the computer system. At the proper time, the customer retrieves it and pays it through electronic funds transfer (EFT) to the supplier's bank account. The only paper necessary in this transaction is the bank statement. In more sophisticated systems, the computer system can monitor inventories and automatically generate orders to suppliers.

The use of Universal Product Code (UPC) bar coding and Quick Response (QR) are two other technologies that are integrated with EDI. The UPC is the link that allows trading partners to do business in a common language. Along with pricing information, bar codes can contain such information as shipper, manufacturing location, date of shipment, and carton or unit contents.

Quick Response (QR) is the integration of EDI and bar coding. Unit level bar coding used with EDI allows businesses to manage inventories and receive bar code generated electronic

shipment information prior to arrival of the goods. Integration of UPC bar codes, data scanning and collection equipment, data networks and automation software for sales personnel can minimize in-house inventories and maximize retail sell-through.

To maximize the effectiveness of EDI technology, business must develop partners. Partners plan jointly, sharing production schedules, buying forecasts, shipping, accounting and other business information. Wal-Mart is the acknowledged market leader in innovative supply techniques. One of Sam Walton's visions was of building the business on stronger relationships between the vendor and merchandiser. His genius was in building this philosophy into his company and steadily developing it over the years. By sharing "proprietary" information, once highly secret and guarded, adversarial transaction-based relationships become strategic alliances in the business industry.

According to Bert Flickinger, a consultant with A. T. Kearney, "A lot of what is being done under the efficient consumer response banner is just people using EDI and claiming their total system efficiency is better - even though they have affected no fundamental changes in their business processes. What's required to achieve faster service is a fundamental change in operational relationships. Unless suppliers can forge these kinds of extended relationships, they will wake up in five years and find themselves in the bone yard."

Major corporations such as Wal-Mart, Target, Sears, and other high distribution companies are beginning to put major pressure on these vendors to use EDI services. In the near future there will be little tolerance for slow moving and out of stock inventories or excess buffer inventories. Market analysts predict that many businesses will fail because of their inability to adapt a more streamlined, cost-efficient supply process. By the end of the decade, EDI may no longer be the fast lane.

EDI USAGE IN MILITARY APPLICATIONS

Such adaptations have been being made in military system for the several years. EDI is used extensively in both the wholesale and retail supply operations within the Department of the Army and the Department of Defense. The wholesale supply operations for the Department of Defense is controlled by the Defense Logistics Agency and the Department of Army is controlled by the Army Material Command. All organizations within the Department of the Army receive the supplies through retail operations. The retail operation uses EDI through the Standard Army Retail Supply System (SARSS). In this system requests are generated at the unit level and processed through the computer system to the division level. At this point decisions are made to forward or unfinance based on availability of dollars. If forwarded through the system, the requests go to the National Inventory Control Point (NICP) where shipping instructions are given to the depots. This information is in turn sent to the receiver prior to the shipment. Upon receipt of the shipment by the organization, notification is made to the division level and serial numbered items and items with a value of over three hundred dollars are automatically recorded on the organizations property book. The procurement of local stocked expendable items is accomplished in the same manner except they are recorded through a point of sale terminal using a scanning

device to document the bar code information. This information is used to record pricing, inventory adjustments, and to order replacement stock. Prior to the implementation of EDI all of these steps were totally in a pen and paper mode which took literally months to process and receive supplies. Utilization of EDI technology has reduced this time to less than three weeks from the ordering of the supplies to their receipt at the order initiating level.

Mortgage brokers and their wholesalers are in their infancy with electronic data interchange. Both brokers and wholesalers suffer from significant communications problems. EDI technology holds great potential for linking up the wholesale business so brokers and correspondents don't feel worlds apart from their wholesalers. There are a number of reasons broker-wholesaler communications inefficiencies perpetuated. The reasons range from the retail production emphasis or origination systems that lack wholesale lending functionality, to the proliferation of broker targeted software packages that don't interface with wholesaler systems, to painfully slow adoption of EDI standards.

Currently broker communications require the following five functional activities: (1) registration where brokers/correspondents supply the wholesaler with enough information to the price loan, (2) rate communication where wholesalers make available their most current loan products and rates to all participating broker organizations, (3) rate lock-in where brokers affix a firm interest rate to the borrower's loan and alert the wholesaler of their intent to deliver a loan at that interest rate, (4) loan file submission where the loan file with complete documentation is handed over from the broker to the wholesaler, and (5) interim communications, including the wholesalers confirming the terms of the lock, as well as loan status updates, additional information needs, and conditions for underwriting review and approval. In this operation communication scenarios vary widely, but generally the business transaction is initiated when the broker calls the wholesaler with a potential loan and supplies enough information to lock in the loan. The communicating from that point basically does not exist until the file arrives at the wholesaler to fund the loan. Most brokers do not have automated systems to manage or track loan progress within their organizations.

EDI AND INFORMATION QUALITY

In order to remain competitive going into the next century significant advances must be made concerning automation in this industry. This means a technology that makes communication easier and faster. The adoption of EDI standards will greatly improve this capability. Currently, this industry is investing in one form of EDI which is video teleconferencing. This technology supports communication between wholesalers and brokers during the underwriting process by connecting the broker and borrower in one room with the wholesaler's underwriter off site. In conjunction with the organization system it provides functionality that enables key underwriting information to be electronically transmitted to the underwriter. Even through the use of the technology all problems are not yet solved. There is still a major problem in that brokers don't have a common software system to communicate with their own organizations and the wholesalers. Without an effective means of connecting the wholesaler and broker through technology,

however, adoption of automated underwriting services could suffer.

Electronic data interchange has resolved to develop proprietary interface to end this problem. Given that we currently live in the world of non-standard data formats and structures, the prospect of two different systems talking to each other is not as easy as mapping a data field in one system to a data field in another system. Often a direct field to field correspondence does not exist. Proprietary interfaces between vendor organization's systems used by brokers and internal wholesaler systems can be further complicated by the fact that not all versions of a vendor's system are necessarily compatible with the interface. This means that all are not using the same version. Under a standardized EDI such interfacing could not pose a problem.

Some wholesalers have capitalized on the concept of giving their brokers tools to communicate more efficiently with them, thereby securing a competitive advantage. Even though EDI technology is an expensive investment, it is a must for survival. Those who invest will survive into the next century while those who procrastinate will find themselves on the losing edge of technology.

EDI has significantly changed the way the Federal government conducts business. As mentioned earlier, the Federal Acquisition Streamlining Act of 1994 was the big step for the government towards EDI. The Act repealed or substantially modified more than 225 provisions of law to reduce paperwork burdens, facilitate the acquisition of commercial products, enhance the use of simplified procedures for small purchases, transform the acquisition process to Electronic Commerce, and improve the efficiency of laws governing the procurement of goods and services. The most significant provisions of the new law include:

- Emphasizing the acquisition of commercial items;
- Streamlining acquisition procedures under an elevated small purchase threshold;
- Implementing a Government-wide Federal Acquisition Computer Network;
- Establishing uniformity in procurement system;
- Improving protest and oversight process; and authorizing specific pilot programs.

FACNET BASED ON EDI

The Federal Acquisition Computer Network (FACNET), mentioned above, was established as a result of the Act. It required the government to evolve its acquisition from one driven by paper to an expedited process based on EDI. The electronic system is intended to provide a single face to industry. FACNET is designed to:

- Inform the public about Federal contracting opportunities;
- Outline the details of government solicitations;
- Permit electronic submission of bids and proposals;

- Facilitate response to questions about solicitations;
- Enhance the quality of data available about the acquisition process; and
- Be accessible to anyone with access to a personal computer (PC) and a modem.

The hardware, software, and communications infrastructure components necessary for the implementation of EDI are in place. The systems infrastructure is the interconnected communications and computer capability supporting the exchange of EDI transactions between Government agencies and their trading partners. This infrastructure consists of a seamless network of Gateways, Network Entry Points (NEPs) and Value-Added Networks (VANs) through which electronic document flow. A Gateway consists of both hardware and software that improve EDI translation services, archiving, security, and environment management or converting non-standard business application systems data into a standard ANSI X12 format to Government procurement agencies. Gateways typically support numerous Government business systems. Gateways serve as the point of access to the Federal Acquisition Network (FACNET). A Network Entry Point (NEP) is a collection of hardware and software systems which provides communications connectivity between Value Added Networks (VANs) and the government Gateways to support the exchange of EDI transactions between Government procurement agencies and private sector Trading Partners. There are currently two NEPs, one located in Columbus, Ohio and the other in Ogden, Utah. A Value Added Network (VAN) is the third party communications network that may also provide services such as electronic mailboxes, where registered Trading Partners can retrieve a document and reply electronically. Trading Partners are the vendors that are involved in the process that wish to sell their products or services in the government.

The exchange of EDI data happens when information from a Government agency, such as a DOD contracting office is sent through an application system to the supporting Gateway. After translating, archiving, and other processing by the Gateway, the information is transmitted to a NEP. NEPs receive the EDI transactions and transfer them to VANs that have been certified and are connected to the DoD infrastructure. VANs distribute the EDI transactions to their customers in ANSI X12 format. EDI transactions are reverse order. Once a document leaves the procurement activity, the actual flow of the document through the EDI network is seamless and transparent to you as a user.

As noted above, all Government EDI data must comply with ANSI X12 standards. The American National Standards Institute (ANSI) is the coordinator and clearinghouse for national standards in the United States. ANSI does not develop national standards; it charters organizations called "Accredited Standards Committees (ASCs)" composed of voluntary representatives from industry, labor, consumer, and government to prepare consensus standards. Upon public comment and approval, ANSI ASCs public national standards. The ASC X12 was chartered to develop the structure, format and content of business transactions conducted through Electronic Data Interchange (EDI). The ANSI X12 standards and transaction sets are EDI Transactions that involves the transmission of a business document in the form of a transaction set that is prepared in accordance with an ANSI X12 standard for that document. In other words, a transaction set is the electronic equivalent of a document, such as a Purchase Order or Request for

Quotation, enclosed in an "electronic envelope." There are currently almost two hundred transaction sets supporting the following business areas: communications and controls, product data, purchasing, industry standards transition, distribution and warehousing, and insurance.

GOVERNMENT APPLICATIONS USING EDI

How does a company do business with the Government via EDI? The first step is vendor registration. The registration is conducted electronically via EDI. Companies are required to register so that the Government knows who they are and will be able to accept bids from the company. The registration process provides the Government with necessary information for the Government to send EDI solicitation documents, such as request for quote documents. It is thus the first step in establishing a trading partner relationship with the Government. The Government contracting community needs information that is useful and accurate; it must know who you are and where you are located. Each company referred to as a Trading Partner is assigned a distinctive identification number.

The information required of Trading Partners is:

- Company name
- Address
- General point of contact for information (name, phone, fax, E-mail)
- Electronic data interchange point of contact
- Contractor Identification Numbers
- Electronic data interchange VAN and address.

The Contractor Identification Numbers consist of four types of numbers or codes. The first is the Commercial and Government Entity (CAGE) code. It is administered by the Defense Logistics Systems Center (DLSC) in Battle Creek, Michigan and is used in supply management. This code is required if a Trading Partner intends to do business with the Department of Defense (DoD). Next is the Taxpayer Identifying Number (TIN). This was developed by the Internal Revenue Services (IRS) and is required by the Code of Federal Regulation. The TIN consists of two types of identifying numbers: Social Security numbers and employer identification numbers. The Data Universal Numbering System (DUNS) was developed by Dun and Bradstreet Corporation in 1962 to identify businesses in its automated files. There are approximately 11 million numbers issued to active domestic firms. The numbers are used by 54 industries to identify Trading Partners for EDI. The Standard Industrial Classification (SIC) Codes are required when registering to do business regardless of the type or size of business. SIC codes are obtained from the Small Business Administration.

PROCUREMENT, PURCHASING, AND QUALITY UNDER EDI

With all of the technical jargon that is thrown at a company, one might ask, "How does this work?" For a procurement being made by a DoD purchasing activity, it is a twelve step process. First, the purchasing agent issues an electronic Request for Quotation (RFQ) from the automated contracting information system that he or she is using. For most Army purchasing and Contracting activities, they use the Standard Army Automated contracting System (SAACONS). SAACONS host then transmits the site's RFQs to the DISA operated Gateway using SAACONS EDI, a special add-on to the SAACONS software. The Gateway then responds with an acknowledgment that the transactions were received. In step 3, the Gateway translates the RFQs to ANSI X12 format and transmits the X12.840s to the Gateway and then to the DISA certified VANs. Step 4: QuickBid or other commercial off-the-shelf software packages are used to supply the connection to the electronic bid board. GE Electronic Bid Board is only one of many. QuickBid selects and downloads X12.840 and then translates it back to text format for easy viewing. Step 5 involves the vendor or supplier to enter quotation information on the electronic copy of the RFQ. QuickBid then translates the quotation information to X12 format and transmits to the X12.843s to the GE Bid Board. As each RFQ is received, it downloaded to the NEP and then uploaded from the NEP to the Gateway. The quotes (X12.843s) are then translated to ASCII text format at the Gateway and then downloaded to each procurement office. Bids and quotes are then imported into the SASCONS database using SAACONS EDI. Step 8: The DoD buyer/purchasing agent then evaluates the bids, selects the winning bidder and generates a purchase order transaction using SAACONS. The SAACONS host then transmits Purchase Orders and Award Notices to the Gateway using SAACONS EDI. The Gateway responds with an acknowledgment that the transaction was received. In Step 10 the Gateway translates the Purchase Orders to X12.850s and Award Notices to X12 format. The Gateway then transmits them to the NEP. The NEP uploads the data to DISA certified VANs. In Step 11 of the process, the winning bidder downloads the X12.850s (electronic purchase orders) from the electronic bid board. Then the software package that the bidder uses, such as QuickBid PC, translates the X12.850s back to text format for easy viewing. Unsuccessful bidders download the Award Notice from the electronic bid board the same as the successful bidders download their awards. This last transaction closes the loop of the acquisition process.

Not only has the inventory control process and the acquisition process changed, but also vendor payment for government contractors. This is Financial EDI. The process that the Defense Finance and Accounting Service (DFAS) has implemented is called Vendor Express. What is it? Vendor Express is "direct deposit" for business that provides goods and services to Federal agencies. Payments are made electronically through the Automated Clearing House (ACH) network for deposit directly into the vendors bank account on the payment due date. Vendor Express provides the vendors bank with payment information which identifies the reason for the payment, such as an invoice number or the amount billed. This information is contained in an "electronic check stub" called an ADDENDUM RECORD. The federal agency originates and sends both the payment and the addendum record to the vendor through the bank.

Currently there are three forms of ACH being used by the banking industry. They are: (1) Cash Concentration or Disbursement Plus (CCD+) which is a payment format used for a single payment, single addendum record (invoice); (2) Corporate Trade Payment (CTP); and (3) Corporate Trade Exchange (CTX) which are payment formats with single payment and multiple addendum records.

The Small Business Administration has identified the following benefits of Vendor Express. They include, but are not limited to:

- No deposit delays
- Prompt availability of funds
- Better cash management
- Payment and information move together, creating the opportunity to automate updating of accounts receivable
- No lost or stolen checks
- Fully traceable payments

In order for a business to implement Vendor Express, there is a fairly easy process to undertake. First, the vendor must make sure that their bank can actually accept and transmit electronic payments. Then the vendor must:

1. Design a primary Vendor Express contact in the company;
2. Assign implementation roles and responsibilities between accounts receivable representative, cash management official, and Federal agency representative;
3. Determine how addendum information provided by the agency will be received internally by accounts receivable and cash management officials;
4. Identify the appropriate official in the bank who can assist the company with receiving ACH payments; and
5. Discuss the Vendor Express Bank booklet in detail with the firm's bank contact.

The banking industry, although involved with EFT payments for some time now, is still looking for "quantum leaps" for productivity. These quantum leaps will be easier by three emerging technologies: (1) artificial intelligence, (2) imaging, and (3) smart card technology. These emerging technologies will help bank management to reduce or replace clerical staff, improve customer service, and reshape branch banking. EDI is one of five disciplines converging into the banking payments system of the future. The other four are ECP (electronic check presentment), imaging, networks, and outsourcing check clearing to bank-owned cooperatives. These will provide significant cost savings to the banks of the future.

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